



*Superconducting Magnet Division*

*Magnet Note*

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# INTEGRAL FIELD MEASUREMENTS OF THE SNS PROTOTYPE 27CDM30 CORRECTOR MAGNET

J.Jackson and C.Spataro

This note reports a measurement of the integral magnetic field and its harmonic content for the SNS 27CDM30 corrector magnet manufactured by Danfysik and received at BNL in September 2001.

The measurements were performed to verify that the magnet met the specifications of the purchase contract.

The magnetic field was measured using the AGS Booster integral harmonic coil (radius=7.94cm). All measurements were made at 13.0 amperes which is the maximum design current.

For all the following tables, the boxed terms indicate the field normalization for each measured configuration of the magnet and all harmonics are expressed in percent relative to that boxed term, e.g., the normal sextupole term is  $-0.51\%$  relative to the normal dipole term in the vertical dipole configuration of the magnet (Table I). The pertinent field integral is given for each configuration at 7.94 cm radius.

Table 1 shows the dipole integral field and harmonics (skew and normal) for the vertical and horizontal dipole configurations.

Table II shows the skew quadrupole integral field and its harmonics for the skew quadrupole configuration.

Table III shows the quantities for the skew sextupole configuration and for a repeat measurement at a later date. Note the relatively large skew dipole term which was due to an error in conductor placement during the winding process.

Table IV shows the results of adding several additional turns (powered in the opposite direction) to the skew sextupole coils. This revised configuration results in reducing the skew dipole by a factor of approximately two. A revised design<sup>1</sup> to reduce the skew dipole harmonic and revised drawings have been completed and Danfysik is constructing a new first article magnet.

We thank E. Hoey for his careful work in the setup and the harmonic measurements of the corrector magnet.

<sup>1</sup> N.Tsoupas, private communication, 9/2001

VERTICAL DIPOLE  
(Measured 9/17/01)

n	$a_n$	$b_n$
1	0.01	100.00
2	0.16	0.28
3	0.01	-0.51
4	-0.01	0.02
5	0.00	-0.03
6	0.00	0.00

$$\left(\int \mathbf{B} \cdot d\mathbf{l} = 8399 \text{ G} \cdot \text{cm}\right)$$

HORIZONTAL DIPOLE  
(Measured 10/5/01)

n	$a_n$	$b_n$
1	100.0	0.18
2	-0.08	0.05
3	-0.65	0.00
4	-0.01	0.01
5	-0.03	0.00
6	0.00	0.00

$$\left(\int \mathbf{B} \cdot d\mathbf{l} = 8285 \text{ G} \cdot \text{cm}\right)$$

Table I

SKEW QUADRUPOLE  
(Measured 9/18/01)

n	$a_n$	$b_n$
1	-0.54	0.72
2	100.00	-0.34
3	0.04	0.00
4	0.01	-0.04
5	-0.01	0.02
6	0.15	0.01

$$\left(\int \mathbf{B} \cdot d\mathbf{l} = 2160 \text{ G} \cdot \text{cm}\right)$$

Table II

SKEW SEXTUPOLE  
(Measured 9/20/01)

n	a <sub>n</sub>	b <sub>n</sub>
1	-22.8	-0.1
2	2.0	-0.1
3	100.0	-0.7
4	-0.1	0.1
5	-2.9	0.2
6	-0.2	0.0
7	-3.2	0.0
8	0.1	0.0
9	0.6	0.0

$$(\int B \cdot dl = 411.5 \text{ G} \cdot \text{cm})$$

SKEW SEXTUPOLE (REPEAT)  
(Measured 10/1/01)

n	a <sub>n</sub>	b <sub>n</sub>
1	-22.0	-0.1
2	1.3	-0.6
3	100.0	0.2
4	-0.1	0.1
5	-2.8	0.2
6	-0.2	0.0
7	-3.1	0.0
8	0.0	0.0
9	0.7	0.0

$$(\int \mathbf{B} \cdot d\mathbf{l} = 411.8 \text{ G} \cdot \text{cm})$$

Table III

SKEW SEXTUPOLE (NEGATIVE TURNS ADDED TO REDUCE DIPOLE TERM)  
(Measured 10/2/01)

n	a <sub>n</sub>	b <sub>n</sub>
1	-11.6	0.0
2	1.4	-0.2
3	100.0	0.1
4	-0.1	0.2
5	-2.2	0.1
6	-0.2	0.1
7	-3.4	0.0
8	0.0	0.0
9	0.7	0.0

$$(\int \mathbf{B} \cdot d\mathbf{l} = 397.8 \text{ G} \cdot \text{cm})$$

Table IV